



## MANUFACTURE OF A FOLDING TOP FOR A CONVERTIBLE

*sub A7*

The invention relates to a device for manufacturing a folding top of a convertible of the introductory portion of claim 1, as well as of the introductory portion of claim 8 and to a method of the introductory portion of claim 10.

The DE 298 17 980.6 discloses the attachment of a frame region of a folding top to a rear window, which is encircled by this frame region, the rear window itself not forming a frame and being connected directly to the frame region of the folding top by means of an interposed welded sheet. The objective of such a connection is to achieve as flat a frame region as possible, which borders the rear window, or a different window held within the folding top, without a bead-like protrusion, in order to be optically unobtrusive and to ensure good visibility, which is not limited by protruding frames.

Since only a narrow region of the edge of the windowpane is taken hold of by the frame region of the folding top, an accurate alignment of the parts to one another is necessary.

Ans A37

It is an object of the invention to make it possible to manufacture folding tops by machine, the folding tops encircling a windowpane, particularly a rear window, which is encircled directly by a frame region and is otherwise frameless.

Pursuant to the invention, this objective is accomplished by a device with the distinguishing features of claim 1 as well as by a device with the distinguishing features of claim 8 and a method with the distinguishing features of claim 10. With regard to advantageous developments, reference is made to claims 2 to 7, 9 and 11.

By means of the inventive device, an accurately fitting connection between the windowpane and the surrounding frame region can be brought about. At the same time, the frame region can be part of, for example, a flexible folding top fabric and held in the device firmly and aligned. In this position, the rear window is brought along and aligned over the fixing device in such a manner, that only a very narrow overlapping region to the rear window is formed. By these means, the field of view can be retained almost over the whole size of the windowpane.

If the fixing device comprises thrust elements, which act on the windowpane over its edges, the windowpane need not be taken hold of by holding elements. A "possibly reactive" adhesive, applied in the edge region of the windowpane, is therefore not affected by the fixing device. The thrust elements preferably are distributed around the windowpane in order to be able to produce

a thrust from any direction and thus be able to transfer the windowpane from any defective position into an accurately fitting end position. It is particularly advantageous in this connection if the holding elements are coupled to one another and can be moved simultaneously in this coupled position. The coupling can be constructed in the form of a surrounding strap of a screw clamp, by means of which a force is exerted on all thrust elements in the same way. Accordingly, by exerting tension on the surrounding strap, the same end position of the window frame is necessarily reached without the need for a separate control program for this purpose.

A particularly advantageous development arises if the thrust elements are held at a subassembly, which is to be opened and which, in the open position, does not interfere with the insertion of the windowpane. For example, two pivotable supporting frames can be constructed for this purpose, which can be coupled together in the closed position and thus overlap the frame region of the part encircling the folding top.

For the construction of an electrode, which grips the frame region from below and has a shoulder, the sewing or gluing of a bend of the frame region can be taken into account. The region, turned over, need not extend over the whole width of the electrode. Instead, it need only be a few millimeters up to a few

centimeters wide and nevertheless, experience a supporting surface with a uniform heat input in the electrode.

It is particularly advantageous if the inside edge of the windowpane is overlapped by a covering strip, in order to achieve an optimally pleasing termination from the inside and to form a mechanically-stable connection by the double holding of the edge of the windowpane from both sides. In order to make such a connection possible, two operational steps are provided in the device. Initially, in the first step, the part of the folding top, encircling the frame region, is connected with the windowpane and, in the second step, the covering strip is welded to the outer part of the folding top.

Further advantages and details arise out of an example of the object of the invention, which is shown in the drawing, in which

Figure 1

shows the inventive device with the subassembly opened and after the insertion of the part of the folding top, encircling the frame region, in a perspective view,

Figure 2

shows the device of Figure 1 after the windowpane is brought along and fixed,

Figure 3 shows a plan view of the device in the position of Figure 2, the driving elements for moving the thrust elements being shown by broken lines,

Figure 4 shows a section along the line IV-IV of Figure 3,

Figure 5 shows a view, similar to that of Figure 4, after vacuum fixing,

Figure 6 shows a view, similar to that of Figure 5, during the welding or gluing of a frame part, as well as of the covering strip with the windowpane,

Figure 7

shows a view, similar to that of Figure 6, during the welding or gluing of the covering strip treating the part of the folding top, which embraces the frame region for the rear window and

Figure 8 shows a convertible vehicle with a folding top, produced by the inventive method, shown in a perspective view.

Figure 9

The convertible vehicle 1, shown in Figure 8, has a folding top 2, which is provided with a rear window 3, which is bordered by a frame region 4.

The device 6 of Figure 1 is provided in order to make possible the connection between the part 5 of the folding top 2, encircling of the frame region 4.

The device 6 comprises a support 7 for the part 5 of the folding top 2, encircling the frame region 4. The frame region 4 can be provided so that it embraces a windowpane 3 completely or partly. The support 7 can be constructed, so that the part 5 can be held completely on it; this is also possible in the case of a flexible part 5, for example, by folding in regions of the part 5.

The device 6 furthermore comprises a fixing device, which has been labeled 8 as a whole, for the accurately fitting alignment and holding of the windowpane 3 in the device 6. The fixing device 8 comprises individual elements 9, which act on the windowpane 3 and, at the same time, are able to fix and hold it in the processing position. In the example, the elements 9 are constructed as thrust elements; this is not absolutely necessary.

The thrust elements 9 are held in sliding-block guides 10, which are essentially at right angles to the edge 11 of the inserted windowpane 3 and necessarily impose a specified path of motion on the thrust elements 9, essentially at right angles to the edges 11 of the windowpane 3. At least one driving organ 12, which actuates several or all thrust elements 9 over a revolving linkage 13, is

provided for moving the thrust elements. The movement of the thrust elements 9 therefore necessarily is synchronized.

A linkage 13, which can be actuated over two synchronized driving organs 12, is connected at a coupling site 14, is shown in Figure 3. Instead of the two driving organs 12, which are shown, one would also suffice, provided that coupling 14 makes it possible to lock the thereby connected linkage appropriately.

The revolving linkage 13 is connected over force-transmitting levers 16 1, which can be swiveled about fixed fulcrums 15 with frame bodies 17, which move the thrust elements 9. In the example, in each case two thrust elements 9 are taken up in a frame body 17. In the case of a pulling motion of the linkage 13 in the direction of the arrow 18, the frame bodies 17 can be moved by pulling in the piston rods of the driving organs 12 over the levers 16 and swiveling them about the axes of rotation 15. Owing to the fact that the thrust elements 9, on the one hand, are accommodated in the frame bodies 17 and, on the other, are guided in the sliding-block guides 10, the thrust elements 9 can move perpendicularly only to the extent of these sliding-block guides 10. The conversion of the swiveling motion of the levers 16 into strictly a transverse movement of the thrust elements 9 comes about owing to the fact that the levers 16 engage the frame bodies 17 in elongated holes 19, as a result of which the swiveling component of the movement of the levers 16 is intercepted and only the lifting motion of the thrust elements 9,

acting perpendicularly to the windowpane 3, remains. Due to the rotating linkage 13, it is ensured that all thrust elements 9 are moved in the same manner so far that, with the windowpane 3 inserted, all thrust elements exert pressure with the same force on the edge 11 of the windowpane 3. At the same time, the windowpane reaches its fixed end position, in which it can be held by a vacuum pump 20 below the plane of the extension of the windowpane.

The fixing device 8 is disposed as a whole at a subassembly 21, which can be moved between an open position (Figure 1) and a closed position (Figure 2). For this purpose, the subassembly 21 comprises two supporting frames 22, 23, which are laterally fastened and can be swiveled about horizontal axes. In the open position, the supporting frames 22, 23 are essentially vertical and therefore do not affect the access to the support 7.

The supporting frames 22, 23, actuated by motor or by hand, can be shifted over handles 24 into the closed position of Figure 2.

As can be seen in Figure 4, the folding top part 5, in order to connect it with the windowpane 3, is taken up with the region 4 of the frame overlapping the windowpane edge in a lower electrode 26 in such a manner that, due to the stepped configuration of the electrode 26, the sewing or gluing of the bend of the frame region 4 is taken into account. The turned-down part of the frame region 4 is



therefore supported in such a manner that, in the turned down region as well as in the thereon adjoining single-layer region of the folding top part 5, the upper surface is at the same level, so that the thrust elements 9 can be shifted into their path of motion without a shoulder and the lower edge region 11 of the windowpane 3 is gripped from below by a flat, undergrasping part of the folding top.

The shoulder 27 is aligned parallel to the edge 11 of the windowpane and runs around the window pane 3 in the whole frame region 4.

For welding, gluing, reactive gluing, weld gluing or a similar connection between the windowpane 3 and the frame region 4, the part 5, which takes hold of the frame region 4, is placed, to begin with, in the device 6, the sub-assembly being in the open position and therefore not interfering with the insertion. The sub-assembly is subsequently closed and the window pane, here the rear window 3 is placed down. A force 13 is exerted by the driving organ or organs 12 on the linkage parts in such a manner, that the thrust elements 9, which are disposed around the inserted rear window 3, are moved centrally towards one another and, in so doing, always reach the same end position, in which the windowpane 3 can be shifted from any direction into the fixed end position. The path of motion of the thrust elements 9 extends parallel to the extent of the plane of the windowpane.

In this position (Figure 4), a vacuum suction 20 for the windowpane 3 is activated, so that the latter is placed in the now fixed position on the frame region 4 of the folding top part 5. This work is carried out against the force of a support spring 28.

The actual connecting process by weld gluing or other thermal methods is carried out in two steps and shown in Figures 6 and 7. To begin with, an inner covering strip 29, which borders the edge region of the window pane 3 in about the same width as the frame region 4, is placed on the so fixed and lowered window pane 3. By lowering an upper electrode 30, which also extends over this width, for a defined period of time, heat is introduced into the connecting zone, as a result of which the welded or glued connection, for example, also the reactive glue connection, is brought about. After that, the fixing of the windowpane 3 by means of the thrust elements 9 is undone. These therefore move, as can be seen in Figure 7, to the outside and thus free a region, in which the covering strip 29 lies free above the outer layer of the part 5, comprising the frame region 4. By lowering the second electrode 31, heat can be introduced (Figure 7) into a region, which lies outside of the edge 11 of the windowpane and in which the covering strip 29 and the outer layer of the part 5 are pressed onto one another and connected with one another.

With that, the windowpane is bordered on both sides on the inside by the covering strip 29 and on the outside by the outer part 5, placed on the bend, the appearance and the mechanical stability thus being improved. The extent of the region of part 5, placed on the bend, can be kept very small by the shoulder 27 so that, contrary to what was the case with previous devices, it is no longer necessary to create an overlapping region, which is several centimeters in size.